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Community Solid Waste Disposal

Proceedings of March 14-15, 1957, Meeting of *ad hoc* Study Group

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of State Services
Division of Sanitary Engineering Services

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Recommendations of task groups of the Ad Hoc Study Group on Community Solid Waste Disposal are presented. Included are recommendations concerning administrative and related aspects and training, information needed on solid wastes collection practices, and disposal methods and systems.

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PREFACE

COMMUNITY HEALTH AND SOLID WASTE DISPOSAL

The benefit to community health gained through sanitary solid waste disposal practice is a concept which must be reached by rationalization and deduction. The probability that a given unsanitary condition on a given day resulted in a given case of disease rarely can be stated in concrete terms. However, this is not a unique situation in public health and communicable disease control, and should not be misconstrued as acquittal of insanitary waste disposal practices.

It is a recognized fact that flies, rats, and mosquitoes are known vehicles of disease agents and that insanitary methods for the storage, collection, and disposal of solid wastes result in conditions which provide food, harborage, and breeding media for these vectors of disease. As is the case in many communicable disease control practices, the total environment of the disease agent must be considered and the attack directed to those factors in the chain of transmission which will yield the desired results.

Insanitary waste disposal is like the unprotected water supply, or cross-connection in the distribution system, which could, under certain conditions, serve as the vehicle for the transmission of disease organisms throughout the community. There are many analogies which have become accepted through the years as people have obtained a broader understanding of health and well-being -- that good health is something more than absence of disease and infection.

When it becomes a generally accepted concept that sanitary storage, collection, and disposal of solid wastes is a factor in community health, responsibility for improved or corrective action can be designated. It then follows that the degree of sanitation to be achieved can be adjusted to the stage of healthful living which the community desires and can afford.

Ad Hoc Study Group on
Community Solid Waste Disposal

This report has been prepared in limited quantity for a special purpose, and should not be included in reading lists or journals as generally available.

Proceedings of *ad hoc* Study Group on COMMUNITY SOLID WASTE DISPOSAL

March 14-15, 1957 Washington, D. C.

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of State Services
Division of Sanitary Engineering Services General Engineering Program

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The expressions and conclusions of The Ad Hoc Study Group represent the thinking of this group and not necessarily that of the various organizations represented.

RECOMMENDATIONS

From Task Groups

A. ADMINISTRATIVE AND RELATED ASPECTS AND TRAINING

1. The attempts to obtain reliable basic data on the solid wastes problem by the use of questionnaires have not only given limited results, but, in many instances, have caused concern and confusion when the data were misinterpreted because of failure to recognize the vitally important differences in local conditions and practices. Reporting based upon inadequate or incomplete records further complicates the situation. The Public Health Service can well take the lead in a continuing program to develop and assemble accurate and carefully appraised data that would be of lasting value to consulting engineers and public officials.

2. Basic standards and criteria for the collection and disposal of solid waste could be established for policing purposes, the avoidance of epidemics, fire prevention, prevention of air pollution, insect and rodent control, and general nuisance abatement. Standards and criteria would serve as guides for program evaluation, as devices for informing government officials regarding alternate methods of approach to the problem and as basic data for conducting public education and information programs.

It is considered quite feasible to develop a comprehensive survey procedure to permit the classification of collection and disposal practices in general categories of good, adequate, and unsatisfactory. The survey would reveal the details and rationale behind the classification, thus enabling the community to analyze its own problems and take the necessary corrective measures.

3. Sanitary engineers should improve professional knowledge and practice in this field through participation in the professional development programs of their various societies. For example, the Sanitary Engineering Division of the American Society of Civil Engineers is preparing a manual of practice on the municipal incineration of refuse.

4. Special provisions should be made for the training of sanitary landfill and incinerator operators and collection supervisors through the cooperation of interested groups such as State health departments, universities, professional societies, and equipment manufacturers. This should result in annual short courses for operating personnel similar to those frequently held for water and sewage plant operators.

5. Training needs in the supervisory group can, and should, be attained by the inclusion of the solid wastes problem in graduate and undergraduate curricula of engineers and sanitarians. More emphasis should also be given to the problem in State and Federal in-service training courses. The production of material such as brochures, motion pictures, and film strips should be expanded and made available to all persons interested in the problem.

6. Basic research and development on elements of the problem such as nuisance abatement measures; development of standards for acceptable stack emissions for incineration; development of improved reclamation and market for reclaimed products: development of comprehensive survey procedures on refuse characteristics and quantities (reliable and extensive data); research on basic combustion; research on materials of construction; comprehensive compilation of the work of the different professional organizations on the various phases of the solid waste problem and the like are not generally in the province of the professional societies. Accordingly, the broad field of research lies within the public domain. Because of the health and welfare connotations and national economic significance, the Public Health Service, in cooperation with foundation-supported university research, would be the appropriate agency to foster such research.

7. Public officials and engineers should be more fully oriented to the needs for broad preliminary studies in this field of presently limited practice.

8. To safeguard the public interest, State authorities should require that collection and disposal plans be prepared by qualified sanitary engineers and other experts.

9. Public recognition of the necessity for engineering procedures to be utilized in solving these problems should be sought. Continued education through municipal publications, releases from State health departments, the Public Health Service short courses for administrative officials, and similar procedures are indicated. Health agencies as well as organizations such as the American Public Works Association and the American Municipal Association should take an active part in making public officials aware that engineering in the field of solid wastes is specialized and complex, and that there are available professional personnel, in private and public practice, who are specialists in the field.

B. COLLECTION

The following program recommendations are presented as a basis for securing needed information on solid wastes collection practices:

1. The Public Health Service to plan and supervise, in cooperation with interested local agencies, nationwide field studies to collect, analyze, and disseminate data on the operation of representative municipal refuse-collection systems to aid in the evaluation of operational efficiencies;

2. The American Public Works Association to consider the advisability of developing test procedures for evaluating performance of refuse collection equipment;

3. The Public Health Service to initiate a nationwide public education program designed to promote better refuse storage practices, in recognition of the current improper storage practices of many communities.

C. DISPOSAL

1. Promote the use of satisfactory methods in communities with recognized inadequate refuse disposal systems;

2. Demonstrate new, technically sound, and potentially acceptable methods of refuse disposal;

3. Conduct research to improve the design and operation of existing methods of refuse disposal, both to minimize the present disadvantages, and to reduce net costs;

4. Conduct research to obtain necessary basic information and to develop new methods and techniques for refuse disposal; and

5. Encourage the development and enforcement of high standards of sanitation for all methods of refuse disposal.

These general recommendations should be implemented by the following specific, but not exclusive, approaches:

1. Demonstrate outdoor-aerobic refuse composting and develop reliable net overall cost data on a plant scale;

2. Increase present efforts by basic research centers to determine the chemical and physical characteristics of representative refuse by major geographic regions;

3. Increase research on incineration to develop more efficient and economical materials handling, storage facilities and techniques and to develop improved design and operation of municipal, industrial, and commercial incinerators in order to minimize air pollution and reduce net cost;

4. Encourage the development and enforcement of high standards of sanitation for hog feeding as a method of disposal;

5. Conduct research to develop acceptable and economical on-site refuse disposal methods;

6. Investigate feasible methods for further reclamation of useful materials in refuse; and

7. Encourage long-range planning for refuse disposal in metropolitan complexes.

AGENDA

MEETING OF AD HOC STUDY GROUP ON COMMUNITY SOLID WASTE COLLECTION AND DISPOSAL

March 14 - 15, 1957

Room 5051 - Health, Education, and Welfare Building,
Washington, D. C.

Thursday Morning - March 14, 1957

Mr. Gilbertson - presiding

9:30 - Introductions ..... W. E. Gilbertson

10:00 - Background and Objectives of Meeting ..... Dr. O. L. Anderson

10:15 - Nature and Extent of Problem, A Summary
Review of Available Data ..... Leo Weaver

10:45 - Current Public Health Service Program
Activities - Moderator ..... Malcolm C. Hope

Communicable Disease Center
Atlanta, Georgia ..... Richard J. Hammerstrom

Robert A. Taft Sanitary Engineering Services
Cincinnati, Ohio ..... Andrew H. Rose, Jr.

Division of Sanitary Engineering Services
Headquarters - Washington, D. C. ..... Arthur H. Neill

11:15 - 1. Designation of Task Study Groups ..... Malcolm C. Hope
a. Collection (technical)
b. Disposal (technical)
c. Administrative and Related Aspects including training

2. Election of Task Study Group Chairmen

12:00 - Luncheon Meeting of Task Group Chairmen

Thursday Afternoon - March 14, 1957

Task Study Group Chairmen - presiding

1:00 - Individual Task Study Group Meetings

Discussion of:

a. Definition of Problem
b. Adequacy of Current Practice
c. Unmet Needs
d. Possible Action Programs (municipal, State, Federal, academic, other)

Friday Morning - March 15, 1957

Task Study Group Chairmen - presiding

9:00 - Development of Task Force Reports

11:00 - Typing of Reports

Friday Afternoon - March 15, 1957

Mr. Gilbertson - presiding

1:30 - 1. Individual Task Study Group Reports
Group Session ..... Study Group Chairmen

a. Collection (technical)
b. Disposal (technical)
c. Administrative and Related Aspects (including training)

2. Discussion of Possible Action Programs

3:30 Summary and General Conclusions ..... W. E. Gilbertson

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BACKGROUND, PURPOSE AND MECHANICS OF THE CONFERENCE

A broad appraisal of the need for better solutions to the complex problems of community disposal of solid wastes was the "raison d'etre" for this study group conference.

In keeping with a proposal of the American Public Works Association, the Surgeon General of the Public Health Service invited representatives of various national organizations and associations, consulting engineers, and Federal, State and local officials to consider these problems and make suggestions as to needed courses of action.

After a brief presentation of municipal refuse practices, including current research and training activity, the Study Group was sub-divided into three working groups, i. e. collection (technical), disposal (technical), and administrative and related aspects (including training). The working groups met independently to consider for each of these phases, a) the definition of the problem, b) adequacy of current practice, c) unmet needs and, d) possible action programs (municipal, State, Federal, academic, others). The afternoon of the second day of the meeting was devoted to a general discussion of the reports prepared by the three groups. A summary of the conclusions of the chairman based on this discussion is included as an addendum to the reports of the three groups.

Opening Remarks
by
OTIS L. ANDERSON, M. D., Chief,
Bureau of State Services
United States Public Health Service

On behalf of Dr. Leroy Burney, the Surgeon General, I am delighted to welcome you here today. The United States Public Health Service is glad to have the opportunity to serve as host to many important gatherings. The pleasure today is much keener, however, in view of the uniqueness of this group in terms of both its membership and its mission.

It is my impression that this is the first time a group of scientists and engineers of your stature, representing a variety of disciplines, have met to appraise with a national perspective the manifold problems concerned with the disposal of community solid wastes. Each organization represented here today, and each of you as highly respected specialists, have been carefully selected to ensure the reflection of a significant point of view, attitude, approach, or experience with respect to the subject you are to discuss. The study and analysis of problems of community solid wastes from a variety of vantage points will, I am sure, result in a set of recommendations or suggestions which will constitute a positive force for future developments in this field.

The problem of community solid waste or refuse disposal has many implications. For some years, a number of studies have corroborated the significance of both the health and economic aspects of community waste and refuse disposal to the community's well-being.

The health aspect is most clearly observed through the demonstration that sanitary refuse practice on a community-wide basis is of primary importance in controlling insect and rodent vectors of communicable diseases, particularly rats and flies. The failure to exercise adequate sanitary waste control is equally demonstrable; thus, the indiscriminate and improper burning of refuse has been identified as a significant contribution to the air pollution problem of certain metropolitan areas.

The potential economic impact of improper solid waste disposal methods was dramatically demonstrated a few years ago when an agricultural emergency was declared as a result of the nationwide spread of the swine disease, vesicular exanthema. You may recall that the practice of feeding raw garbage to swine was identified as a primary source of this outbreak. In a very short time the practice of feeding raw garbage to swine was brought under regulatory controls. Today, the U. S. Department of Agriculture reports that more than 90 percent of garbage-fed hogs are given cooked garbage.

It is a bit ironic to reflect on the fact that it has been known for years that trichinosis infection in Man is caused by the improper cooking of infected pork from hogs fed raw garbage. Trichinosis infection in man has not been accompanied by morbidity rates or epidemics that excited attention. On the other hand, vesicular exanthema was quickly identified as a disease threat to swine by a spectuacular and dangerous epizootic. A positive program of controls, as you know, was activated.

In any event, this example and similar evidences of the past suggest that in many areas of public health only limited efforts have been made to initiate over-all, comprehensive action--action that might lead to the improvement of available technological knowledge as well as applying what is already available. Frequently, strenuous efforts are made to refine and extend our technology when, in fact, not all has been squeezed out of the knowledge we already possess. Our goal is to do both.

For reasons such as these, the Public Health Service welcomed the resolution of the American Public Works Association, calling for a comprehensive review of the many problems in the solid waste area. This study you are undertaking is, as you already know, a challenging one. Much hard work is ahead as you look to the resolution of the many problems in this field.

The activity and problems of refuse disposal have always been a local problem and remain so today. Technical and administrative know-how is not available in many communities for handling these problems. Such information does exist among university faculties, independent research centers, and other professional groups.

Counsel and assistance is available from such representative groups as the American Public Works Association, the American Municipal Association, and the Council of State Governments. The individual and collective contributions of groups such as these to a community's solid waste problems can be considerable and significant. It is our policy, as you know, to develop close working relationships with professional societies and associations as well as official agencies concerned with these problems.

This policy has demonstrated its great value through sound programs that have been developed to guard and improve our Nation's health.

In the two days of your deliberations, you will probably be able to consider only the broader aspects of the problem before you. Technical reports on the many facets of solid waste disposal are in agreement on one important fact--that the problem warrants more engineering and scientific attention. How this is to be accomplished, and by whom, has apparently never been resolved satisfactorily. It is our hope that the deliberations of this group will constitute a substantial effort toward rectifying this situation.

You have our most sincere appreciation for the time you have taken from your busy schedules to sit down with us today to tackle the important subject of this conference. I wish you a very successful meeting.

COMMUNITY SOLID WASTE DISPOSAL

The Nature and Extent of the Problem

by
LEO WEAVER
Sanitary Engineer
Technical Services Section
General Engineering

Basically, the problem of community solid waste disposal is one of good housekeeping. The problem may be discussed in many ways. Comments will be offered under the following categories:- environmental health implications, economic significance, current research, basic data collection, training, and current operating practices.

ENVIRONMENTAL HEALTH IMPLICATIONS

The environmental health implications of poor community housekeeping extend beyond the consideration of esthetics and nuisances. Definite health hazards are connected with the collection and disposal of solid wastes. Probably the first substantial scientific evidence implicating a method of refuse disposal as a cause of a disease in humans in the United States was obtained in the 1930's through studies on the incidence of trichinosis (1). The feeding of raw garbage to hogs was identified as an important factor in the infection of swine with the parasitic nematode trichinella spiralis. It was also determined that the infection was transmitted to humans when undercooked meat from such infected animals was consumed.

However, the reported morbidity rate was low, and mortality was rare. The economic stakes, however, were high. Many cities depended on this method for the disposal of their garbage. It was honestly believed that the relatively simple remedial measure of cooking the garbage before it was fed to the hogs would bring chaos to the industry and probably create more garbage disposal problems than the step was supposed to remedy. It was not until 1952, when the spectacular epizootic of vesicular exanthema caused an agricultural emergency and raised the economic stakes, that the remedial measure was taken. This is an excellent example of motivation when one considers underlying causes of trends in the field of community solid waste disposal.

During the late 1940's studies showed a significant relationship between the reduction of diarrheal disease in certain areas and the control of flies. It was further demonstrated that insecticides alone could not control flies; the elimination of man-made breeding places was a basic necessity in continuing an effective control program. Other disease vectors, such as the Aedes egypti mosquito, a potential carrier of yellow fever, were found breeding in water retained in rubbish such as automobile tires and tin cans. The recognized need for disease vector control may seem sufficient reason to initiate remedial action. Again, experience has shown that this is not always the case.

Most people are motivated into doing something about rats and flies not so much because of the potential disease hazards, but because of the nuisance value and general repulsiveness of these pests. This motivation is important in the consideration of a third significant development in recognition of the need for good community housekeeping. Disposal of refuse by burning in the backyard or in poorly designed and operated incinerators, or in community dumps may be considered a significant source of air pollution. The degree of significance varies widely depending on local conditions and practice. Again, however, most people do not like nuisances created by smoke and odors which are discharged into the atmosphere regardless of whether or not we can link such activities to the incidence of the common cold or to maladies such as cancer.

ECONOMIC SIGNIFICANCE

In the past, $4 or $5 per capita per year was considered a good average figure representing the cost of operating a municipal refuse collection and disposal system. Where a system was adequately operated, the money spent was often the largest single expenditure in the public works operating budget.

Recent data obtained through a survey by the Refuse Collection Committee of the American Public Works Association showed that in 1955, 582 cities with a total population of more than 50 million reported expenditures of $225 million for the collection and disposal of refuse. Interpolating this data, it is estimated that municipal governments in the United States expend $. 5 billion annually to operate refuse collection and disposal systems. Further, if the amount expended by industries, businesses, and individual householders were known, the bill for the disposal of community solid wastes could be in excess of $1 billion a year.

CURRENT MUNICIPAL PRACTICE

Summary reports of current municipal refuse collection and disposal practice are presented in Appendix C.

The data were obtained from two separate surveys of the three phases of refuse disposal, namely, premises storage, collection, and disposal. One survey made several years ago was on practices in 765 communities with less than 5,000 population. The other survey, on practices in 908 cities with more than 5,000 population, was made by the Refuse Collection Committee of the APWA in 1956.

Storage Regulations

Twenty percent of the 765 cities of less than 5,000 population reported having some regulations on refuse collection and disposal. Sixteen percent reported regulations on home storage. Of the 908 larger cities, 82 percent reported having some regulations on premises storage. No data are available on the effectiveness of enforcement of the regulations in either group.

Collection

Of the smaller cities, 574 reported on the responsibility for the collection of garbage as follows: direct municipal operation, 32 percent; municipal contract, 38 percent; private arrangement, 30 percent. About 740 communities reported on the collection of residential combined refuse as follows: direct municipal responsibility, 37 percent; contract, 10 percent; and private arrangement, 53 percent.

Of the 893 larger cities reporting on collection, 72 percent indicated that combined refuse is collected either by municipal forces only or in conjunction with municipal contractors or private arrangements. Fifteen percent of the cities indicated the exclusive use of contractors, and 11 percent reported pickup by private collectors as the only method in current use. Two percent reported use of a combination of contractors and private collectors.

Data on frequency of collection were reported by 291 of the larger cities. Of these, 54 percent provide semi-weekly collection of refuse containing garbage. Where garbage is collected separately, 198 or 66 percent, reported collections at least semi-weekly during the summer.

In the smaller communities, 57 percent of the 698 reporting cities provide, during the summer, semi-weekly collection of garbage or of refuse containing garbage. Many other phases of the collection operation could be used as indices of current practice, including equipment use and development.

Disposal

More information is readily available on the disposal methods used by the various communities than on any other phase of the solid wastes problem, because information on disposal is, generally, the least difficult to collect.

Of the 667 smaller cities reporting on their method of disposal, 539 (81 percent) use open dumps1 159 (24 percent) reported disposing of garbage by feeding it to hogs; 18 (3 percent) use incinerators; and 32 (5 percent) use sanitary landfills. These percentages do not add up to 100 because some communities use more than one method.

Of the larger cities, 851 reported as follows: 482 (57 percent) use sanitary landfills, and 124 (15 percent) use incineration, (some use both methods); 261 (31 percent) reported using the open dump. In addition, about 10 cities use a central grinding plant; 1 or 2 still have a reduction plant in operation, and 5 reported "dumping in water" as a method of disposal. The water may be groundwater in an excavated trench or a convenient river or lake.

At the end of 1956 on the basis of available supplementary data, some 1, 100 or 44 percent, of the 2, 500 cities having more than 5, 000 population use the sanitary landfill and/or incineration for refuse disposal. Therefore, it would seem reasonable to assume that the remaining 1, 400 still use the open dump.

Finally, although there are at least several pilot plant composting operations functioning in the United States, no community has currently reported disposing of refuse by composting as a primary method.

CURRENT RESEARCH

The Refuse Section of the Committee on Sanitary Engineering Research of the American Society of Civil Engineers published in February 1957 the results of a preliminary survey of research conducted in 1956. The research activities in the refuse engineering field were reported as follows:

1) The American Public Works Association has a Refuse Collection Committee and a Refuse Disposal Committee, each charged with the responsibility of conducting or stimulating investigations to aid in the compilation of a comprehensive manual of practice. The Collection Committee in 1956 completed a nationwide survey of refuse collection and disposal practices. Much of the data presented today comes from this survey. The Disposal Committee has made progress in collaborating with Purdue University to request a Public Health Service research grant for a study of appropriate methods of obtaining representative samples of

municipal refuse and to accurately determine the physical and chemical characteristics of refuse in representative cities across the Nation.

2) The American Society of Civil Engineers has an active committee preparing a manual of practice on incineration. A second committee is preparing a manual of practice on sanitary landfill. These groups are relying on data already available as resource material.

3) The Refuse Section of the American Society of Civil Engineers Committee on Sanitary Engineering Research is currently surveying cities with incinerators in an effort to determine and evaluate the adequacy of existing incinerator plant designs.

4) The California State Water Pollution Board is continuing an investigation of the effect of landfill refuse disposal on the production and dispersion of organic and mineral pollution of groundwater.

5) New York University, under research contract, is investigating the improvement of incinerator design.

6) Mr. B., at the University of California (Los Angeles), is continuing research on the discharge of particulate matter from incinerators.

7) Mr. D., at the University of Washington, is continuing investigations on gas production in the Seattle sanitary landfills.

8) The California health department has reported, and is continuing research on, the relationship of type of earth cover and its compaction to fly emergence from buried refuse.

9) A number of cities, including New York, Los Angeles, and San Diego, have made investigations in an effort to solve certain local collection and disposal problems. Some of this data has wide application.

10) The Air Pollution Control Association has a technical coordinating committee, T-2, with a subcommittee interested in municipal incineration.

11) The American Society of Mechanical Engineers has an Air Pollution Control Committee which also is interested in municipal incineration. This committee sponsored jointly with the Fuels Division a session on incinerator design at the ASME semi-annual meeting in June 1956.

Very likely, additional work is being performed elsewhere, but the above represents the bulk of the present effort.

Some thorough research projects have been completed in recent years. Probably the foremost was conducted at the University of California at Berkeley, and included work on collection system design, incinerator design, and landfill investigations as well as work on the technology of composting refuse.

Finally, noteworthy research conducted by private groups, includes a pilot plant study of a Dano-type process of composting, currently operating at Sacramento, and research and development on the design of a satisfactory household incinerator. It is often difficult to evaluate these efforts, since the results obtained are proprietary and therefore restricted in terms of general availability. This is a partial summary of research efforts on the solid wastes problem. However, if data on research expenditures in this field in 1956 were available, the amount would probably not exceed $100,000, even including research by the larger municipalities.

COLLECTION OF BASIC DATA

The collection of sufficient accurate data on actual municipal practices in the collection and disposal of solid wastes in the United States has presented difficulties. The available data have limited value because of the variety of practices in thousands of communities and the difficulty of getting uniform reports. No overall or long-range plan for the collection of data currently exists by which the needs of the various communities can be evaluated in terms of the many sociological and technological changes that have taken place in recent years.

Much of the available data have been collected through the efforts of such organizations as the APWA and ASCE, which were seeking clarification of specific, immediate problems. Once the data was collected and published, this problem was considered solved, for the moment, at least, and another group, perhaps, started from the beginning in solving its immediate problem. The data thus developed bore little relationship to each other.

A number of organizations currently have committees of some kind involved in data collection varying from a nationwide survey to simple polling in a few cities.

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TRAINING

The term "training" refers to design and management studies at the university level, and includes operators' short courses, symposiums, and the like, held individually or sponsored jointly by State health departments, the Public Health Service, and associations and societies.

Although there are more than 1,000 sanitary landfills reported in the United States, there are no formal courses or training other than "on-the-job-training" that can be taken by responsible individuals who wish to learn how to do a better job. Only on-the-job-training is available to management and operational personnel of over 200 incinerators. Opportunities for training in solid waste disposal for engineers are extremely limited. Even if appropriate training was currently available, there is reason to question whether many engineers would realize the need or take advantage of such training.

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PUBLIC HEALTH SERVICE ACTIVITIES

The Communicable Disease Center

In the Public Health Service environmental health activities are conducted to determine: how communicable diseases are transmitted; which are the specific and important disease vectors; and what the best practical methods are for controlling vectors. At the Communicable Disease Center, among other tasks, work on control of insect and rodent vectors of disease is an important facet of community communicable disease control. Because adequate sanitation is an essential part of disease-vector control, the CDC is concerned with research and development and demonstrations in the field of solid wastes collection and disposal. Current activities include:

1) Community Demonstration Projects. Two-year projects are being conducted at Gadsden, Alabama; Boise, Idaho; and Cedar Rapids, Iowa. These projects are designed to demonstrate the significance of environmental sanitation in a community's disease-vector control program. Demonstrations of safe and sanitary refuse collection and disposal systems are an integral part of these projects.

2) Research. The potential of the composting of municipal refuse as well as putrescible wastes from food-processing industries is being investigated. Laboratory research on the development of suitable high-rate mechanical composting methods is being conducted at the Communicable Disease Center Technical Development Laboratories in Savannah, Georgia. Also, a field investigation, on a pilot plant scale, of the feasibility of developing economic methods of composting refuse by relatively simple field-storage methods using a minimum of mechanical equipment is being conducted at Phoenix, Arizona.

Lawrence B. Hall

Division of Sanitary Engineering Services

In the Division of Sanitary Engineering Services a Refuse Sanitation Unit within the General Engineering Program is specifically charged with the responsibility of collecting basic data, developing guides, and furnishing technical assistance to other Federal agencies, State and local health departments, and other local authorities concerned with the collection and disposal of solid wastes. This unit has developed and maintains close working relationships with national organizations and professional societies with an interest in this field. For example, it works with the American Public Works Association in the revision of a manual of practice on refuse collection and the development of a similar manual on refuse disposal.

The Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio, is the research arm of the Division of Sanitary Engineering Services. One of the Center's primary program responsibilities is the planning, evaluation, and direction of the national program for measurement, prevention, and control of air pollution. A study of design factors applicable to multiple-chamber municipal refuse incinerators for proper combustion processes to prevent air pollution is currently under way. A study on the development of adequate design criteria for single-chamber incinerators employing the principle of tangentially fed over fire air is being carried on under a contract arrangement with the Bureau of Mines.

A. H. Neill and Andrew H. Rose

REPORTS
of
Conference Task Study Groups

A. Administrative and Related Aspects and Training

B. Collection

C. Disposal

ADMINISTRATIVE AND RELATED ASPECTS AND TRAINING

I. The Problem

The problem, stated in its simplest and most comprehensive terms, is to resolve the many difficulties involved in achieving economic and sanitary collection and disposal of community solid wastes resulting from:

1) Nonacceptance of responsibility by some communities.

2) Vagueness of the relative functions of the agencies usually involved.

3) General lack of adequate regulatory criteria.

4) Dearth of basic data, standards, and practice criteria.

5) General lack of availability of suitable training courses at both the professional and subprofessional levels.

6) The public's, as well as the public officials', failure to recognize the importance of adequate collection and disposal of solid wastes.

II. Background Comments

The exact form of organization under which the collection and disposal of solid wastes is administered is of less importance than the quality of the administrator. Administration is never better than its chief administrator. Men with ability can make most plans work if they are determined to do so.

However, given a favorable arrangement, the administrator can do a far more effective job. Whatever form the local government takes, and whether the community operates its own services or engages a private contractor for the work, a good job can be done.

Basically, the adequate collection and disposal of solid wastes is the administrative responsibility of the local governmental unit having jurisdiction over the area in which the wastes are produced. This applies whether such responsibility is exercised directly by providing adequate municipal or county services, or indirectly through contractual arrangements by the government agency with contractors or appropriate regulatory controls over contractors.

Like most other governmental services and activities, community solid waste collection and disposal is divided into two phases -- provision of the service and the enforcement of standards and regulations. The success of either phase is closely allied to clear and definite assignment of responsibilities to the departments concerned as well as the maintenance of constant coordination of activities subsequent to such assignment.

In the ideal situation, the State health department would maintain on its staff sanitary engineers competent in the engineering features of collection and disposal of solid wastes to:

a) Advise with consulting engineers and with public works officials regarding design and operations.

b) Develop criteria for the establishment or construction of facilities.

c) Consult on technical operations and "trouble shoot" as necessary.

d) Evaluate as occasion may warrant the technical operation of facilities in accordance with engineering design.

e) Provide technical and consultative support to local health departments as requested.

Under the ideal situation, too, the local health department will maintain a staff of sanitarians and, perhaps, in the larger city or county health department, one or more sanitary engineers to:

a) Vigorously promote the establishment of effective community procedures for on-site storage collection and disposal of solid wastes.

b) Evaluate the effectiveness of the results of community practices.

c) Investigate all complaints of health hazards, nuisances, etc., associated with refuse collection and disposal problems and operations.

d) Institute necessary procedures for enforcement of standards and prosecution of violations.

e) Collaborate with public works and other local officials in adapting operations to specific needs of communities.

f) Coordinate with State health department in effectively utilizing technical services of the State engineering staff.

The public works agency (or comparable department), under the same ideal situation, through its own staff or the services of consultant engineers, will maintain and discharge primary responsibility for:

a) The design of systems and facilities.

b) All service operations including quality and amount of service.

c) Maintenance and repair.

d) Evaluation of efficiency of performance operations.

e) Coordination with State and local health departments in meeting community sanitation objectives.

This pattern will, of necessity, vary according to differences in concept of State-local administration or differences in size of communities. However, emphasis should be placed upon definition of the relative functions of the several responsible agencies. It is axiomatic that the greater the assumption of local responsibility, the more effective local acceptance and performance is likely to be.

III. Adequacy of current practice

Many local governments have fully accepted the administrative responsibility for the collection and disposal of solid wastes produced within their boundaries. Many do not accept this responsibility. Depending on local practice, there is need for substantial improvement in all of the problem areas mentioned in the first paragraph in the majority of the Nation's cities.

IV. Unmet Needs

1. There is a need for legislation for the control of solid waste disposal. Generally speaking, such legislation would be premature at present. Technical criteria on disposal techniques are inadequate, and a large part of the public is unaware of the importance of the problem. Considerably more study of solid waste disposal techniques is needed, and the public must be educated to the need for improved disposal methods before action is initiated on the legislative approach to the problem.

2. Training in the collection and disposal of solid wastes is greatly needed for the professional supervisory group and for the subprofessional operating group.

3. Accurate basic data is fundamental to the administrative development of sound and economic systems of solid waste collection and disposal. There is a well-recognized lack of authoritative published information based on engineering determination and evaluation of the scope of the problem, as well as a lack of dependable economic and performance criteria for comparative purposes.

4. The development of a comprehensive survey procedure and an interpretive set of standards and criteria are essential for defining the solid waste disposal problem for the administrator. Althouth there must be differences from one community to another in waste disposal practices, there is sufficient material in common to justify the establishment of minimum standards and criteria.

V. Possible Programs

(Refer to RECOMMENDATIONS page 1.)

COLLECTION

I. The Problem

The problem is to find the most satisfactory sanitary and economic methods for the storage, collection, and transportation of municipal refuse to the point of disposal.

II. Background Comments

Adequate collection and disposal of solid wastes in urban areas are essential to a sanitary environment. Collection includes on-site storage, pickup, and transportation to the disposal site. These operations constitute major sources of potential hazards to community health.

Collection is a service, and it is always desirable to improve service. However, maximum service is often limited by costs and special conditions in each locality. Although the method of collection is determined by the techniques and procedures of final disposal, collection accounts for some 75 percent of the total cost. Therefore, the greatest economies can be effected in the collection operation.

Although it is difficult to establish universal standards because of local variations in costs and conditions, minimum standards are essential to avoid nuisances and health hazards.

To establish minimum standards, analytical studies of collection practices in representative cities are needed. Data developed from such studies could be used as a guide to deal with local technical and personnel problems, and could also be used as the basis of a scientific approach to the problem.

Questionnaires are considered inadequate for such studies. Information should be gathered by professional personnel in cities equipped and willing to cooperate in a review of their collection operations. The conditions of each study must be reported in a consistent style so that the data will be useful.

Also, communities of all sizes should be encouraged to test the adequacy of collection equipment under actual operating conditions. Too often, equipment is purchased as the result of superior salesmanship alone or blind acceptance of another city's procedures without examination.

In some cases, for example, it could be demonstrated that ordinary trucks are as efficient as mechanical-packer trucks. Testing would serve to further stimulate manufacturers to make the desired products.

The adequacy of collection in unincorporated areas is open to question. The basic problems involved are considered to be more legal and administrative than technical. However, it is suggested that the Public Health Service and local health and interested agencies give more attention to this problem.

III. Adequacy of Current Practice

Information is not available for evaluating quantitatively the adequacy of current refuse collection practices, although such practices in many communities are obviously inadequate to control public health hazards and nuisances.

One of the major inadequacies is the lack of public compliance with existing regulations on storage practices. Also, there is a lack of useful reliable routine operating records on the various phases of refuse collection practice.

IV. Unmet Needs

The unmet needs are:

1. Application of engineering principles and existing data to the analysis, design, and operation of refuse collection systems;

2. Necessary additional reliable data and information that will permit more effective and advanced analysis, design, and operation of collection systems;

3. Review of existing practices with the objective of developing minimum standards for such functional components of collection systems as, for example, type and size of household storage containers and collection frequencies. It is recognized that universally applicable standards cannot be developed for all components of collection systems.

V. Possible Programs

(Refer to RECOMMENDATIONS page 3.)

DISPOSAL

I. The Problem

The basic problem in the disposal of communities' solid refuse is to find and utilize methods which avoid health hazards and are economically and esthetically acceptable.

II. Background Comments

The extensive growth of urban and suburban population has created sanitary problems at a rate faster than the engineering developments for their control and in advance of community recognition of the problems. This is particularly true of the problem of solid waste disposal. At present, more than half the cities in the United States fail to provide adequate refuse disposal. This failure has produced environmental conditions resulting in such recognized complex municipal problems as atmospheric pollution, water pollution, community rodent and insect infestatious, odor nuisance, psychological disturbances, property value depreciation, and disease transmission.

III. Adequacy of Current Practice

The sanitary landfill is recognized as an acceptable disposal procedure which can satisfy community requirements where suitable land is available within reasonable hauling distance.

In urban areas where land for sanitary fills is scarce and reduction of volume and length of haul are paramount considerations modern high temperature incineration is an acceptable procedure. This method permits disposal of ordinarily noncombustible rubbish such as tin cans and bottles.

The method of disposing of garbage by grinding for treatment with sewage is recognized as satisfactory for meeting the needs of many communities.

When garbage is separated from rubbish and properly cooked, hog feeding, under restricted circumstances and appropriate sanitary regulations is a method of disposal which serves a useful purpose particularly from the economic viewpoint.

Reclamation as a method of disposal of solid refuse has potential for the reduction of overall cost, but is limited in application to favorable market conditions.

Composting as a method of municipal refuse disposal must still be considered as being in an embryonic stage, albeit current experimentation indicates promise of application in the future under some conditions.

The methods of disposal by open dumping, open burning, and dumping at sea do not normally meet the health and esthetic standards which recognized authorities agree to be desirable and which progressive communities demand.

IV. Unmet Needs

Present efforts need to be directed towards promoting the use of the most suitable methods, perfecting techniques, and developing more economical methods of refuse disposal.

V. Possible Programs

(Refer to RECOMMENDATIONS page 4.)

Concluding Comments of Chairman

Wesley E. Gilbertson
Assistant Chief,
Division of Sanitary Engineering Services

The Public Health Service is pleased to have served as host to this group in connection with a comprehensive review and analysis of the problem of community solid waste collection and disposal. We are sincerely hopeful that the discussions during these two days will be helpful in focusing attention on the more significant aspects of this area of municipal sanitation and in stimulating action by the diverse organizations which have an interest.

The conference took cognizance of the fact that problems of community solid waste are varied in nature -- administrative, engineering, fiscal, and legal. Recognition was given to the fact that the collection and disposal of solid wastes require the consideration of professionally qualified personnel. More basic data, analyzed and evaluated, constitute a major need. Such data could serve as "leads" for developing design and operations criteria for equipment. They could help identify and stimulate research. They could assist many municipal officials in making decisions.

An attempt has been made to delineate the general areas of responsibility and relationships of the State and local health agencies and public works departments in connection with solid waste problems. Although it is not our purpose here to solve interagency jurisdictional matters, I believe that the statements in the report on this aspect will be generally accepted. This is worth mentioning because it brings out the question of health agency responsibilities. Collection and disposal of solid wastes is obviously not entirely a health problem. However, there are enough important health implications to require health department attention, encouragement, and guidance. As has been emphasized, this is uniquely a local problem and clear definition of responsibility in the local government will aid in improving performance.

The Task Groups have reported on the unmet needs and possible courses of action in the several aspects of the problem. It is noted that several recommendations have been made for consideration by the Public Health Service. In general these proposals would seem appropriate from the standpoint of national needs. They are of a type closely allied to Public Health Service competencies. However, it should be pointed out that we are at present unable to undertake any major projects due to limited personnel resources in this program area.

The lack of funds for research in this field was noted, but even more was the dearth of worthwhile project proposals from competent investigators. These two aspects were closely linked in terms of the explanation that the Public Health Service research grants are now being opened to a greater recognition of the applied engineering studies of many environmental health problems. This would provide greater support of the kind of research the conference is interested in seeing done.

The Ad Hoc Study Group by a resolution recommended the creation of a Public Health Service Advisory Committee on Community Solid Waste Disposal. It was the considered opinion of the group that the discussions of the various facets of the problem pointed up the need for such an advisory group. This group could be utilized to advise the Public Health Service and others on the problems of basic data collection, research, and administration. This resolution has to be considered in the light of (1) the availability of resources within the Public Health Service to perform effectively in this field, and (2) the ability of the Service to catalyze action through the utilization of such techniques as meetings of this type. It is expected that the recommendations of the study group will be brought to the attention of the Surgeon General for his consideration in connection with the proposal of the American Public Works Association which stimulated this meeting. While no committment can be made at this time, I am sure you realize that the Service has a real interest in this problem and the role of all of the organizations and agencies concerned will evolve as we secure a better definition of needs.

Wesley E. Gilbertson

ADDENDA

FURTHER COMMENTS BY TASK STUDY GROUP MEMBERS

Certain comments submitted by individual members of the Task Groups upon review of the preliminary drafts of the three task group reports were of a nature to preclude their inclusion in the body of the pertinent report without a further review by the Group concerned. To speed publication of the PROCEEDINGS, it was decided to include such statements individually as addenda to the Task Group reports. It is emphasized therefore that these statements do not necessarily reflect the consensus of thinking of the Group.

GENERAL

"All too often local communities are saddled with improperly conceived or hastily improvised systems which are neither practical nor economical in the long run and which are most difficult to correct after the initial error in this direction is taken."

"..... It was unfortunate that no professional planners, fire prevention specialists, or forestry specialists were present. The psychological unacceptability of disposal operations at their best militates against site location and requires extensive promotional effort."

"..... Because of the kind of problem involved, it would also appear desirable that a representative of the National Institute of Municipal Law Officers be included in any further meeting."

"..... regarding bringing into the material coming out of the Conference more specific technical and engineering subject matter in relation particularly to the design and operation of disposal facilities. In my own mind I make a definite distinction between a technical manual which should include available engineering criteria, etc. and the 'cookbook' type dissertation for the instruction of the ..... operator. I am not saying we should not have the latter, but I am strongly insisting that we do not consider it as an accomplishment of the former." Bob Brown

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".....It is also unfortunate that the point is not clearly made that seldom is 'disposal', as discussed here, final, but generally leaves a residuum of material to be further 'disposed of' by air, water, or surface transport after the recognizable solid bulk has been reduced to a minimum so it can be buried or otherwise lodged somewhere at reduced cost."

".....the report.....on Disposal does not entirely meet the practical aspects of the problem. The basic problem in refuse disposal is one of finding the necessary area and volume for dumping, (or of reducing the area and volume required) whether it be open dumping or covered dumping, which has been labeled with the euphemistic title of 'Sanitary Land Fill'. There is an irreducable proportion of a community's refuse (perhaps 25% by volume) which must be disposed of by dumping. It is, of course, important and should be taken for granted that the disposal methods should be sanitary and economical, but this is not the problem."

"In cities where land for dumping is scarce or is not available within economic haul, it becomes necessary to reduce the volume of refuse which must be dumped. In the present status of the refuse disposal field this can best be done by incineration, and there is no real substitute. Hog Feeding, and grinding of garbage will have a minimum effect on the total refuse volume. So also with salvage."

"Composting will reduce the volume if a market can be found for the composted material, but otherwise it appears to be an uneconomical method, considering that it accomplishes less reduction in volume than incineration."

"The method or methods of refuse disposal to be used in any community must always be related to overall costs, including the cost of collection. This again is too often lost sight of."

"In the recommendations there is.....too much emphasis on supposedly inadequate data. It is demonstrable that refuse quantities and characteristics, except for differences due to climate, are [redacted] comparable throughout the country. The differences among individual cities are due primarily to practices

of collection and of separation, including such things as whether the householder is required to separate combustibles and non-combustibles, whether the City collects all refuse or only some kinds and from some types of establishments, the frequency of collection, and whether private scavenging is permitted."

"Here again emphasis is given unduly to such things as hog feeding, salvage and household disposal methods, which may be desirable in some instances for particular reasons, but which have a minor affect on the overall problem of refuse disposal."

".....most serious problem effecting disposal is that of a definite shortage of available land area for disposal purposes. A very great portion of a community's waste must be disposed of by dumping and constitutes solid material with practically no volume reduction. This poses a problem to many of the cities throughout the nation."

"In regard to composting, it is generally conceded that there is little fertilizer value to decomposed refuse and the success of composting on a plant scale would depend upon assured economic demand for this product as a soil conditioner. From information received, the volume reduction of the material received at the plant, when processed, does not compare with the volume reduction obtained through incineration of refuse."

REFERENCES

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

From Public Health Reports

A summary report on refuse storage, collection, and disposal practices in 1,273 cities in 30 States, 1951–54.

Refuse Handling Practices in the United States

By MALCOLM C. HOPE, M.S., M.P.H., CHARLES C. JOHNSON, Jr., B.S. and LEO WEAVER, B.C.E.

THE sanitary storage, collection, and disposal of municipal refuse have been a community problem, in varying degrees, since men first banded together for protection. It is only in recent years, however, that the problem has begun to receive concerted attention and action.

Studies have shown that the sanitary handling of refuse is an important factor in controlling such disease vectors as rats, flies, and mosquitoes. The feeding of raw garbage to hogs has been shown to be not only an important factor in the chain of transmission of trichinosis to man, but also a primary mode of transmission of virus diseases of swine, such as vesicular exanthema. In certain metropolitan areas, disposal of refuse by burning in backyard or apartment-house incinerators has been singled out as a significant source of air pollution. The National Fire Protection Association has reported data indicating that in 1953 "rubbish, ignition unknown" ranked third among 26 known causes of fires in buildings. Furthermore, the public is becoming impatient with the nuisances and inconveniences fostered by inadequate and insanitary refuse-handling systems.

So that the extent of the refuse-handling problem might be better understood and the job which yet needs to be done planned accordingly, the Public Health Service has made an inventory of municipal refuse storage, collection, and disposal practices. During the period 1951 through 1954, data outlining practices of 1,273 cities in 30 States were obtained. These data are summarized in this report. Distribution of the cities according to population group is shown in the following tabulation:

Population group	*Number of cities*
1,000–4,999	765
5,000–9,999	237
10,000–24,999	160
25,000–49,999	55
50,000–99,999	23
100,000 or more	30
Unknown	3

Most of the data included in this inventory were collected by or through State health departments. These data were reported on a

Mr. Hope is chief of the General Engineering Program, Division of Sanitary Engineering Services, Public Health Service. Mr. Johnson and Mr. Weaver are staff engineers in that program.

The inventory reported in this paper was initiated and carried on under the supervision of Ralph J. Van Derwerker and Eugene L. Lehr when they were with the Division of Sanitary Engineering Services. Mr. Van Derwerker is chief sanitary engineer officer of the United States Coast Guard, and Mr. Lehr is assistant chief, Sanitation Services Branch, Division of Indian Health, Public Health Service.

William Xanten, superintendent of sanitation of Washington, D. C., and William Foster, engineering editor of the American City Magazine, among others, assisted in preparing the inventory form.

special inventory form, which the Public Health Service made available to State health departments in 1950. The form, prepared with the assistance of the American Public Works Association and various individuals, had been designed to facilitate uniform collection of refuse-handling data. The rest of the data were secured from published reports of other surveys conducted during the inventory period by State health departments or other agencies concerned with refuse handling.

The data presented in this report must be interpreted with cognizance of two limitations. First, although data were received from 30 States, 98 percent of the cities surveyed were in 17 States located east of the Rocky Mountains. Second, certain of the communities reported on early in the inventory period undoubtedly had changed their practices by 1954. Nevertheless, the information presented may provide assistance in evaluating refuse-sanitation practices in the United States.

The data collected during the course of the inventory show encouraging trends, but they also indicate that, despite the long-standing problem of disposing of municipal solid wastes, the preponderance of the job still remains to be accomplished.

Regulations

Three hundred forty-two cities reported that they had regulations governing one or more of the three phases of refuse handling, namely, storage, collection, or disposal. However, because of the nature of the data on the remaining 931 cities, it was not possible to establish what percentage of the latter actually did not have regulations on refuse handling.

Of the 342 cities, 53 percent had regulations which governed all 3 phases. Twenty-two percent had regulations governing storage only, and another 10 percent had regulations covering storage and either collection or disposal. The remaining 15 percent had regulations controlling collection only, disposal only, or both of these.

Data on the enforcement of regulations were received from 260 cities. Fifty-three (20 percent) of these reported that the regulations were enforced by the police department: 34 (13 percent), by the public works department or the agency responsible for the collection of refuse; 40 (15 percent), by the health department; and 72 (28 percent) reported that enforcement was the joint responsibility of the health department and some other municipal department, such as the police or public works department. (The remaining 61 cities did not specify the enforcement agency.)

Definition of Terms

Refuse: All putrescible and nonputrescible solid wastes (except body wastes), including garbage, rubbish, ashes, street cleanings, dead animals, abandoned automobiles, and solid market and industrial wastes.

Garbage: Putrescible animal and vegetable wastes resulting from the handling, preparation, cooking, and consumption of food.

Ashes: The residue from the burning of wood, coal, coke, or other combustible materials.

Rubbish: Nonputrescible solid wastes (except ashes), consisting of both combustible and noncombustible wastes, such as paper, cardboard, cans, grass and shrubbery clippings, wood, glass, bedding, and crockery.

Storage Practice

Separation requirements. Data on separation requirements were received for 1,244 cities. In 488 (39 percent) complete separation of garbage, rubbish, and ashes was required. Combined storage of all refuse was permitted by 642 (52 percent), and 98 (8 percent) required only the separation of garbage from other refuse. Other requirements, such as separation of combustibles from noncombustibles, were reported by 16 cities (1 percent).

Types of containers. Data concerning the use of covered metal containers for storing refuse are given in table 1. It is encouraging to note that for garbage or refuse containing garbage about 85 percent of the reporting cities required the use of this type of container.

Size of containers. Of the 95 cities reporting on the size of containers used for storing resi-

Table 1. Percentage of reporting cities requiring covered metal storage containers

Class of refuse	Residential		Commercial	
	Number cities reporting	Percent requiring covered metal containers	Number of cities reporting	Percent requiring covered metal containers
Garbage	138	83	119	84
Rubbish	26	58	14	50
Ashes	8	25	6	33
Combined refuse	171	87	131	86

dential garbage, only 12 (13 percent) permitted storage in containers larger than 30 gallons. Where combined storage of refuse was practiced, however, 43 (36 percent) of the 118 reporting cities permitted containers larger than 30 gallons. Table 2 shows the residential container-size requirements reported for each class of refuse.

Data on the size of containers used for commercial garbage from 69 cities showed that 28 (41 percent) required that containers be of 30 gallons or less. Thirty-two (46 percent) allowed the use of containers up to 40 gallons in size, and 9 (13 percent) permitted storage in containers larger than 40 gallons. Where combined storage of refuse was permitted, 57 of 98 cities required that containers be of 30 gallons or less, the remainder permitting the use of containers larger than 30 gallons in capacity.

Collection Practice

Frequency of collection. Tables 3 and 4 show the variations in the frequency of collection for the various classes of refuse according to season of the year. Of the 698 cities reporting on the summer collection of garbage or combined refuse in residential areas, 397 (57 percent) made collections at least twice a week. With respect to summer collection from commercial establishments, 352 (52 percent) of 626 cities reported that garbage or refuse containing garbage was collected daily. An additional 138 (29 percent) collected this material at least twice a week.

As might be presumed, during the winter few cities provided twice-a-week collection. However, 646 (93 percent) of the 691 cities reporting on winter collection of garbage or combined refuse in residential areas provided at least once-a-week pickup of this material.

Point of collection. Information was obtained from 448 cities on the point at which the collection crew was authorized to pick up refuse. As shown in table 5, 190 (43 percent) specified either the curb or the alley, or both, as the pickup point. Two hundred one (45 percent) reported various combinations of curb, alley, front houseline, and rear houseline as being acceptable pickup points.

Responsibility for collection. In table 6 are the data concerning the agencies responsible for the collection of municipal refuse. It is interesting to note that, when each class of refuse is considered separately, there is a similarity between commercial and residential responsibilities. The responsibility for collection of garbage is fairly evenly distributed on a municipal, contract, and private basis.

Combined collection of refuse in more than 50 percent of the communities was accomplished by private or individual arrangements. Analysis of the data showed that 373 of the 393 cities (95 percent) reporting private residential collection were in the 1,000–9,999 population group. On the other hand, only 20 of 112 cities (18 percent) having a population of 10,000 or more utilized private collection, and 79 (68 percent) utilized municipal collection. A similar relationship between population and responsibility for collection was found upon analysis of the data on combined collection of refuse in commercial areas.

Table 2. Size of containers for residential refuse

Class of refuse	Number of cities reporting	Number reporting maximum size of—			Number allowing more than 30 gallons
		Less than 10 gallons	10–19 gallons	20–30 gallons	
Garbage	95	6	20	57	12
Rubbish	22	0	2	10	10
Ashes	9	1	2	4	2
Combined refuse	118	0	13	62	43

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Table 3. Frequency of refuse collection in residential areas

Class of refuse	Summer collection					Winter collection				
	Number of cities reporting	Less than 1 per week	1 per week	2 per week	More than 2 per week	Number of cities reporting	Less than 1 per week	1 per week	2 per week	More than 2 per week
Garbage	284	2	85	151	46	281	3	137	107	34
Rubbish	99	14	35	38	12	98	14	46	30	8
Ashes						19	4	8	5	2
Combined refuse	414	42	172	157	43	410	42	202	127	39

Table 4. Frequency of refuse collection in commercial areas

Class of refuse	Summer collection					Winter collection				
	Number of cities reporting	Less than 1 per week	1 per week	2 or more per week but less than daily	Daily	Number of cities reporting	Less than 1 per week	1 per week	2 or more per week but less than daily	Daily
Garbage	239	2	29	90	118	236	2	53	68	113
Rubbish	94	10	9	24	51	93	10	11	24	48
Ashes						16	3	4	3	6
Combined refuse	387	27	60	93	207	387	26	71	85	201

Types of vehicles. Data on the types of vehicles used in collecting refuse were received from 337 cities having municipal collection. Of these, 157 (46 percent) relied on open vehicles for the collection of refuse. About 10 percent reported the use of covered vehicles, and another 10 percent, mechanical-compactor-type vehicles. The remaining 34 percent reported the use of combinations of these types of vehicles.

Data from 82 cities using contract collection showed that 49 (60 percent) used open vehicles. Only 12 (15 percent) reported the use of the mechanical-compactor type either exclusively or in combination with other types. Data from 147 cities having private collection arrangements revealed that 111 (75 percent) relied on open vehicles. Only 11 (10 percent) reported the use of the mechanical-compactor type either exclusively or in combination with other types.

Table 5. Designated point of refuse collection in 448 cities

Point of collection	Number	Percent
Curb or alley, or both	190	43
Front houseline	10	2
Rear houseline	33	7
Combination of above points	201	45
Other	14	3

Method of financing. Table 7 lists the data reported on the method of financing refuse collections. Of the 633 cities that specified their method of financing, 382 (60 percent) indicated that they relied solely on the fee system. An additional 50 (8 percent) reported the use of both special fees and the general tax fund. An analysis of the data by population group revealed that of the communities in the 1,000–4,999 category, 75 percent relied wholly or in part on the fee system; of those in the 5,000–9,999 category, 67 percent; of those in the 10,000–24,999 group, 63 percent; of those in the 25,000–49,999 category, 48 percent; of those in the 50,000–99,999 category, 34 percent; and of the cities with 100,000 or more population, 39 percent.

Miscellaneous data. Of 561 cities providing information on the private collection of garbage for hog feed, 464 (83 percent) specified that they permitted this practice. However, during the period of this inventory, many communities

Table 6. Responsibility for collection of refuse

Class of refuse	Number of cities reporting	Municipal (percent)	Municipal contract (percent)	Private (percent)
Garbage:				
Residential	574	32	38	30
Commercial	569	30	38	32
Rubbish or ashes:				
Residential	138	64	17	19
Commercial	136	58	17	25
Combined refuse:				
Residential	740	37	10	53
Commercial	740	35	9	56

Table 7. Method of financing refuse collection, according to population group

Population group	Fees	General taxes	Both fees and taxes	Method not specified
1,000–4,999	282	103	21	359
5,000–9,999	52	40	11	134
10,000–24,999	33	25	9	93
25,000–49,999	9	13	3	30
50,000–99,999	2	8	2	11
100,000 or more	4	11	3	12
Total	382	201	50	640

undoubtedly experienced considerable change in the methods by which agencies or individuals arranged to handle garbage ordinarily fed to swine. In 1952, the feeding of raw garbage to swine was shown to be a primary cause of the widespread outbreak of the virus disease of swine, vesicular exanthema, which occurred in that year. By 1955, all but two States had regulations requiring the disinfection of garbage fed to swine. The United States Department of Agriculture reported that as of June 30, 1955, 83 percent of almost 1½ million garbage-fed swine on more than 13,000 garbage-feeding establishments were fed cooked garbage.

With regard to the installation of garbage grinders, 28 of 503 reporting cities (6 percent) prohibited the installation of these devices. Of interest was the fact that 21 of the 28 cities were in the 1,000–9,999 population category.

Of 688 cities reporting on scavenging practice (during the storage or collection period), 139 (20 percent) reported that scavenging was not permitted. Of the cities reporting that scavenging was permitted, almost 90 percent indicated that no license was required.

Disposal Practice

All 1,149 cities reporting on disposal practice indicated the use of one or more of four methods of disposal: incineration, sanitary land fill, open dump, and hog feeding. Ninety-one of the cities (8 percent) reported the use of incineration and 114 (almost 10 percent) reported the use of the sanitary land fill. Table 8 gives the number of cities, according to population category, using each of the four methods.

Table 8. Number of cities reporting use of specified methods of refuse disposal, according to population group

Population group	Number of cities reporting	Incineration	Sanitary land fill	Open dump	Hog feeding
1,000–4,999	667	18	32	539	159
5,000–9,999	221	26	24	131	80
10,000–24,999	156	18	19	76	73
25,000–49,999	53	12	16	25	21
50,000–99,999	20	6	11	7	8
100,000 and over	29	11	11	16	7
Total	[1] 1,149	91	[2] 114	[3] 796	348

[1] Population group not specified for 3 cities. [2] Population group not specified for 1 city. [3] Population group not specified for 2 cities.

Of significance was the fact that 616 (54 percent) of the 1,149 cities reported the use of the open dump as their only means of disposal. Another 130 (11 percent) reported the use of a combination of the open dump and hog feeding as their only means of refuse disposal.

Summary Report

1956 SURVEY

REFUSE COLLECTION & DISPOSAL PRACTICES

American Public Works Association

Refuse Collection Committee

in cooperation with

U.S.Department of Health,Education,and Welfare

Public Health Service

Scope of Survey

A total of 908 cities returned questionnaires. This represents approximately 38% of all cities of over 5,000 population. A breakdown of the cities reporting, according to population grouping, is presented in the following table.

NUMBER OF CITIES REPORTING

Population Group	Number of Cities
1,000,000 and over	5
100,000 to 1,000,000	55
50,000 to 100,000	54
25,000 to 50,000	105
10,000 to 25,000	288
5,000 to 10,000	268
Population not specified	33
Total	908

Storage Regulations

Eighty-two per-cent of the cities reported having some type of regulation on the storage of refuse. Fourteen per-cent of the cities indicated that they had no such regulations. The percentage reporting regulations increased from 74% in the 5,000-10,000 population group to 100% in the 1,000,000 and over population group.

The number of cities reporting various types of container regulations for different classifications of refuse collected are specified in the table below. Thirty-five cities, which is the equivalent of only 6% of the 586 cities requiring containers for garbage, indicated that liners must be used in the containers. A total of 290 cities reported that garbage must be wrapped for collection. This represents 44% of the cities responding to this question.

REFUSE CONTAINERS

Type Of Refuse	Cities Requiring Containers		SPECIFICATION REQUIREMENTS (Reported as % of Number of Cities Requiring Containers)					
	Rept'd. in Numbers	Rept'd. as % of Cities Ans. Ques.	Durable Metal	Tight Lids	Suitable Handles	Max. Size	Min. Size	Max. Wt. Filled
MIXED REFUSE	530	90%	78%	83%	64%	72%	20%	35%
GARBAGE	586	96	88	95	76	72	23	26
NON-COMBUST. RUBBH	259	63	55	47	57	60	15	46
COMBUST. RUBBISH	239	62	58	52	53	56	15	43
ASHES	308	70	66	39	62	55	16	43

The maximum size of refuse container permitted to be used in cities having such regulations is usually in the range of from 20 to 32 gallons. The maximum weight of filled containers is commonly limited to from 50 to 100 pounds in cities that have established this type of regulation. A total of 311 cities reported that bulk materials must be securely tied in bundles for collection; while 80 cities, representing 20% of those reporting, replied that this practice was not required.

The survey indicates that responsibility for issuing notices of violations of refuse storage regulations varies among several different agencies as follows: Health Department 42%, Municipal Refuse Collection Agency 26%, Police Department 6%, combination of two or three of these agencies 15% and various other agencies, such as the Fire Department, 11%.

Collection Practices

Of the 893 cities reporting their method of collection, 72% replied that refuse is collected by municipal forces either totally or in conjunction with contractors or private collectors. Fifteen per-cent of the cities indicated that the contract method of collection was used exclusively, and 11% reported that pickup by private collectors is the only method that is currently used.

Forty-three per-cent of the 808 cities reporting on the point of collection, indicate that containers must be placed at the alley and/or curb; while 38% replied that containers will be picked up at the front or back house line as well as at the curb or alley. Ten per-cent indicate the front or back house line is the designated point of collection; while 9% apparently make no attempt to regulate the point of collection.

Collection frequencies were reported in terms of both summer and winter practice in residential and commercial areas. Fifty-four per-cent of the cities reporting on summer collection of combined refuse (garbage and rubbish) from residential areas indicated that refuse is picked up at least twice per week. An additional 40% reported once weekly collection; while 6% indicated that such collections are made at less frequent intervals, only during clean-up drives, on call, or on an irregular basis. The survey shows that there is no appreciable variation in the frequency of collecting combined refuse during winter and summer months; but there is an increase in the frequency of service during the summer months where garbage is collected separately. In residential areas, 66% of the cities reported two or more collections per week in the summer; while only 50% of the cities make two or more collections per week during the winter months.

The frequency most often utilized with respect to refuse, which does not contain garbage, was indicated to be once weekly both summer and winter in residential areas.

With regard to commercial collections of garbage and mixed refuse, approximately 50% of the cities reported 6 or more collections per week during the summer with substantially the same service provided during the winter.

Municipal Equipment

The types and sizes of municipal collection vehicles in use and the units planned for the next three years was reported in the survey. Of significance is the fact that the number of compactor units planned in the next three years amounts to almost 50% of the number reported in use. It is also interesting to note that 73% of the 2,949 units planned by 264 cities are in the 16-20 cubic yard class.

Working Conditions

Only 14% of the 572 cities reporting indicated that an organized training program is conducted for collection crews. Eighty cities reported that uniforms for refuse collection crews are furnished by the city. Only 26% of the cities responding to the question on Civil Service indicated that refuse collection employees had Civil Service status. Approximately 27% of the cities report that their refuse collection employees are unionized.

Of the 568 cities reporting on their basic work week 38% listed a 44 hour week; 35% listed a 40 hour week; 20% listed a 48 hour week; 5% listed more than a 48 hour week and 2% listed less than a 40 hour week.

Disposal Methods

A total of 851 cities reported on their methods of disposal. Of these, 482 reported the use of sanitary landfills and 124 replied that refuse is disposed of by incineration. These methods are used either exclusively or in combination with other methods of disposal. Only 2 cities reported the use of central grinding as a method of garbage disposal. Five large cities replied that "dumping in water" is their method of disposal; and 261 reported the use of the open dump either exclusively or in combination with the hog feeding method of garbage disposal. One city reported the construction of a composting plant.

The survey also indicates that the number of cities using incineration is increasing and that the rate of construction in 1955, as well as that planned for 1956 and 1957, is substantially higher than that of previous years. Although the adoption of the sanitary landfill method continues, the number of cities initiating this method of disposal has declined slightly during recent years from the peak reached in 1953.

The acquisition of refuse disposal sites is reportedly limited and governed by zoning regulations in 436 of the 742 cities responding to this question.

Household garbage grinders are prohibited in approximately 5% of the cities reporting; while garbage grinders for commercial establishments are prohibited in approximately 10% of the cities.

Costs and Financing Practices

Based on the 1955 refuse collection and disposal expenditures, reported by 415 and 368 cities respectively, and assuming a 7% increase in population over the 1950 census figures, the average annual per capita cost of refuse collection is approximately $4.00 and the average annual per capita cost of disposal is $1.00.

About 32% of the 848 cities responding to the question concerning the method of financing their collection operation reported the use of service fees; while general municipal revenues are used to finance refuse collection operations in 68% of the cities reporting. Refuse disposal operations are financed by general funds in 72% of the cities and by service fees in 28 per-cent of those reporting their financing practices.